



# INTEGRATED CONTROL OF THE GREENHOUSE WHITEFLY

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Programs have been developed that control whiteflies on cucumbers and tomatoes grown in greenhouses. An integrated schedule controls two-spotted spider mites and powdery mildew as well as whiteflies. The biological control agent, *Encarsia formosa* Gahan, parasitizes the nymphs and pupae of the whitefly. When the parasites are properly established, they keep whiteflies at low safe numbers for the rest of the growing season.

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## WARNING

- Recommendations on the use of pesticides are subject to change.
  - BEFORE USING ANY PESTICIDES mentioned in this publication, check with your agricultural representative or provincial authority to make sure your proposed use is still recommended.
  - This warning applies to ALL pesticides including insecticides, herbicides, fungicides, nematocides, and so on.
  - Commercial pesticide products are marketed in a wide range of container sizes and formulations. They are available at garden centers, hardware stores, and pet shops. ALWAYS read labels and follow instructions carefully.
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# INTEGRATED CONTROL OF THE GREENHOUSE WHITEFLY

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## THE GREENHOUSE WHITEFLY

The greenhouse whitefly<sup>1</sup> is a persistent problem in greenhouses where vegetables are grown. It is commonly found on cucumbers and tomatoes (Fig. 1), and occasionally on lettuce. A large number of the ornamental plants grown in greenhouses are hosts for whiteflies.

The adults are about 1/16 inch long and have powdery white wings. They feed and lay eggs on the under surface of young leaves. The eggs are pale yellow at first, but turn gray before hatching in 5–7 days. The small white “crawlers” move around on the leaves for 1 or 2 days, then stay in one place to feed. The nymphs develop fully in 2 weeks at normal greenhouse temperatures. The pupae are slightly larger and thicker than the nymphs. The adults emerge in about 10 days. The complete life cycle takes 4 weeks.

Alternative host plants are important in the seasonal life history of the greenhouse whitefly. In Canada these insects survive the winter only in greenhouses. In the spring the adults leave through doors and ventilators, or on vegetable transplants, and they soon become established on field crops or weeds. The critical time in the annual cycle is in the fall, when whiteflies enter the greenhouse. They may fly in, or be taken inside on ornamental plants such as geraniums or chrysanthemums. A few weeds left in a supposedly empty greenhouse may support whiteflies through the summer.

Adults can not survive for more than a week without food plants, so a break between fall and spring crops eliminates them. During this break there must not be available an alternative source of food, such as weeds or potted flowers. Also, the transplants for the new crop must be kept free from insects.

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<sup>1</sup>*Trialeurodes vaporariorum* (Westwood)





Fig. 1. Whitefly adults on a tomato leaf.

## CHEMICAL CONTROL METHODS

Chemical control of greenhouse whiteflies is difficult, because their habits and natural tolerance for many chemicals make continual treatments necessary. No single chemical controls all stages of the greenhouse whitefly, and one spray will only remove part of the population.

Certain materials may be damaging to the tomato or cucumber plants at high humidities, or if they are applied to tender foliage. Care must be taken to use no more than the recommended amount of chemical for a specific area in the greenhouse.

If you use chemicals to control whiteflies, be careful to leave the correct interval between treatment and harvest. Residues of insecticide on the fruit are hazardous both to the pickers and the consumers for a certain period after treatment.

The latest guide for growers in Ontario is the Ontario Department of Agriculture and Food Publication 365, Greenhouse Vegetable Production Recommendations, which is revised annually. This publication provides information on materials, rates, and interval to harvest for control of the major greenhouse insect and mite problems.

## BIOLOGICAL CONTROL OF WHITEFLIES ON TOMATOES

Biological control methods use a natural enemy, either a parasite or a predator, to control a harmful insect. In 1924, a small wasp, *Encarsia formosa* Gahan, was first noticed to be a parasite of whiteflies. This parasite occurs naturally in Canada, the United States, and England.

The mass rearing of this biological control agent for use in greenhouses was started in England in 1926 and in Canada in 1928. Soon thousands of the tiny wasps were being released to greenhouse operators. However, these parasites were not widely used from 1945 to 1969, because they could not survive where growers had sprayed with DDT or used a fumigant.

### Parasite Biology

The adults are only 1/40 inch long, and have a black head and thorax and a yellow abdomen. All adults except one or two in 1,000 are females who reproduce without mating. The female searches for whitefly nymphs and pupae on the leaves, and lays 50–100 eggs, usually one egg in each whitefly nymph. The parasite larva develops inside the whitefly and turns it black (Fig. 2 shows normal and parasitized whitefly pupae).

The parasite adult (Fig. 3) emerges by cutting a round hole in the top of the black pupal case. The life cycle of the parasite takes 20–25 days in a moderately warm greenhouse.

### Establishing Parasites

- Examine the under surface of the leaves, especially in areas where you see adult whiteflies on the plants, to find the nymphs and pupae.
- When you find the nymphs and pupae, obtain and release parasites in that part of the greenhouse. Place pieces of leaf bearing parasite pupae at intervals along the row. Do not use less than one parasite for each square foot of greenhouse area. To obtain parasites write to the address given on page 7.
- Parasites have become established when you see the blackened whitefly pupae on tomato leaves. Pieces of leaf with parasites on them can be moved to other parts of the greenhouse to start biological control there.
- Some growers have found that the number of parasites may be increased by planting two or three cucumber plants in the corners of each section of the greenhouse. These plants are attractive to whiteflies and parasites, and serve





Fig. 2. Normal and parasitized whitefly pupae on a cucumber leaf.

as a source of parasitized whitefly pupae, as described in the previous paragraph. This practice is useful after you have trimmed the lower tomato leaves from the plants, because parasites may be lost when the leaves are discarded.

- Do not use insecticides or fumigants to control whiteflies.

An application of the fungicide maneb will not harm the parasite, but it will kill many of the young whitefly nymphs and control leaf diseases.

## INTEGRATED CONTROL OF WHITEFLIES ON CUCUMBERS

Tests on the use of both a chemical and the parasite showed that only quinomethionate (Morestan; Chemagro Corporation, Kansas City, Missouri) controlled the whiteflies and was not toxic to the parasite. Sprays of quinomethionate killed some adult whiteflies and most of the eggs. The combined use of the chemical and the parasite, called an integrated control, is very effective. However, quinomethionate is registered for use only on cucumbers, not tomatoes, in the greenhouse. It provides excellent control of powdery mildew on cucumbers and also has acaricidal action against two-spotted mites.

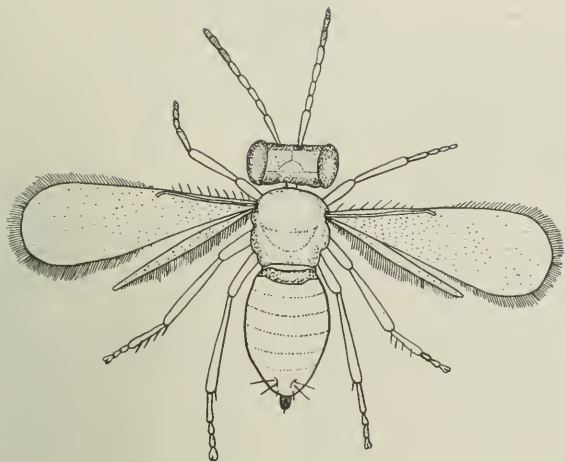


Fig. 3. An adult parasite.

### Schedule for Integrated Control

- When whitefly adults are present, spray quinomethionate at  $\frac{1}{2}$  pound of 25% wettable powder per 100 gallons applied at 7 gallons per 1,000 square feet, or apply 7 ounces of 2% dust per 1,000 square feet.
- Examine the under surface of the leaves to find whitefly nymphs and pupae, especially in areas where adults are noticeable on the upper leaves.
- Obtain and release parasites, as described in the section on biological control.
- Three applications of quinomethionate at 2-week intervals are usually sufficient, but more treatments may be needed to control mildew later in the season.

### Results of Integrated Control

The integrated control schedule does not completely control whiteflies on cucumbers. However their numbers will be reduced so that no damage is done. If the parasites are released at the start of the whitefly infestation, the number of whiteflies and parasites will increase somewhat. The applications of quinomethionate prevent high numbers of whiteflies before the parasites become well established.

## OBTAINING PARASITES

A colony of *Encarsia formosa* is maintained at the Research Station, Harrow, Ontario. Growers in Essex County may find it most convenient to go to the Research Station to pick up their supply of parasites. Shipments are sent by mail to more distant growers. When you send for parasites please enclose your address, the name of the crop, and the size of your greenhouse. Please send any information on the success or problems of the suggested schedule that would be helpful in revising the methods.

Address mail to: Whitefly Parasites, Canada Department of Agriculture, Research Station P.O. Box 370, Harrow, Ontario.

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